Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Work, Energy, and Simple Machines

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. Which gives the correct relationship for kinetic energy?
a. KE = mv
b. KE = mv^2
c. KE = mv/2
d. KE = $mv^2/2$

____ 2. Machines make tasks easier by changing either the magnitude or the direction of the _____ needed.
a. force
b. work
c. energy
d. velocity

____ 3. Which is not a simple machine?
a. pulley
b. ramp
c. bicycle
d. wood screw

____ 4. Which is **not** a part of the walking mechanism of the human body?
a. a rigid bar
b. a fulcrum
c. a resistance
d. a gear

____ 5. What type of simple machine is a flight of stairs?
a. pulley
b. wedge
c. inclined plane
d. lever

____ 6. What type of simple machine is a wheelbarrow?
a. lever
b. inclined plane
c. wedge
d. screw

____ 7. What type of simple machine is most often used to cut things?
a. wedge
b. pulley
c. wheel and axle
d. screw

Problem

8. Carol and Bruno drag a box of mass 58.0 kg along a frictionless floor. Carol pushes the box with a force of 11.4 N at an angle of 40.0° downward from the horizontal. Bruno pulls the box from the other side with a force of 11.0 N at an angle of 40.0° above the horizontal. What is the net work done on the box if the displacement of the box is 14.5 m?

9. A cable pulls a stationary crate of mass 19.0 kg over a frictionless ramp at an angle 20.1° above the ground. If the total distance traveled is 5.40 m, find the work done by the cable on the crate.

10. Raul pushes a stalled car with a force of 204 N. If the required force decreases at a constant rate from 204 N to 44.0 N for a distance of 16.3 m in 16.0 s, calculate the average power required to move the car.

11. A 1600-kg vehicle moves with a velocity of 19.5 m/s. Calculate the power required to reduce the velocity to 3.20 m/s in 11.0 s.

12. Ayesha exerts a force of 186 N on a lever to raise a 2.70×10^3-N object to a height of 29.0 cm. If the efficiency of the lever is 83.3 percent, how far does Ayesha move her end of the lever?

13. A bicycle has a wheel of radius 43.4 cm and a gear of radius 5.20 cm. When the chain is pulled with a force of 152.4 N, the wheel rim moves 15.7 cm. If the efficiency of the bicycle is 92.6 percent, how far was the chain pulled to move the rim 15.7 cm? Also, find the resistance force.
14. Aryton uses a pulley system to raise a 23.1-kg block to a height of 18.0 m. If a force of 124 N is exerted and the rope is pulled 34.2 m, find the efficiency of the system.
15. A worker exerts a force of 119 N on a lever to raise a block. The efficiency of the lever is 91.6 percent. If the lever is moved 0.770 m, the block rises to a height of 0.180 m. What is the mass of the block?
16. Pushing a stranded dolphin back to sea requires a constant force of 600 N over a distance of 30 meters. How much work is done on the dolphin?
17. Pulling a banner behind itself, an airplane exerts a force of 120 newtons over a distance of 550 km. How much work does the airplane do on the banner?
18. You pull your dog on a sled through the snow. You pull up on the rope at an angle of 27° from the horizontal and exert a constant force of 75 N. The sled and the dog move only horizontally, a distance of 950 meters. What work do you do on the sled and the dog?
19. In a dream, you find yourself pushing a huge boulder up a very steep (35°) hill that is 75 meters high. The boulder weighs 22,000 N. Assume that the force needed on flat ground is zero.

    a) What work must you do to push the boulder up the hill?

    b) Is this a reasonable dream?
20. In the previous problem, change the 75 meter figure from the height of the hill to the distance along the path from the base of the hill to the top. Now what is the total work done to push the boulder up the hill?
21. You lift 220 N of water 1.0 m over a table in 0.45 seconds. What power have you generated?
22. In the previous problem, suppose you lift the water and then lower it three times in 1.35 seconds. Now how much power have you generated?
23. Finally, what if you lifted the water only once in 1.35 seconds. How much power have you generated?
24. An ideal pulley system has an MA of 5.0. What distance must you pull the rope in order to lift a 500 N weight 3.0 meters?
25. Two identical 2200 kg cars, traveling at 11 m/s, collide head-on and stop.

    a) What is the change in momentum for each car?

    b) What is the change in kinetic energy for each car?
26. Two identical 2200 kg cars, traveling at 22 m/s, collide head on and stop.

    a) What is the change in momentum for each car?

    b) What is the change in kinetic energy for each car?
27. A lever's efficiency is 95 percent. The work in is 95 J. What is the work out?

28. A wheel and axle with an ideal mechanical advantage of 6 is 67 percent efficient. What is the mechanical advantage of the wheel and axle?
29. You use a knife to cut into a block of cheese. Moving the knife 2.0 cm into the cheese separates the cheese 0.12 cm. Find the IMA for the knife.
30. In the previous problem, the force required to separate the cheese is 110 N, and you press on the knife with a force of 10 N.

    a) What is the mechanical advantage of the knife?

    b) What is the efficiency of the knife?
31. What is the kinetic energy of a 0.145 kg baseball moving at 42 m/s?
32. What is the kinetic energy of a 145 kg football player moving at 0.42 m/s?
33. A seesaw is a lever. Suppose you use a seesaw to lift a bucket of sand. What is the ideal mechanical advantage of the seesaw if the efficiency of the seesaw is 67 percent, the effort force is 36 N, and the resistance force is 144 N?